

# PATENT ABSTRACTS OF JAPAN

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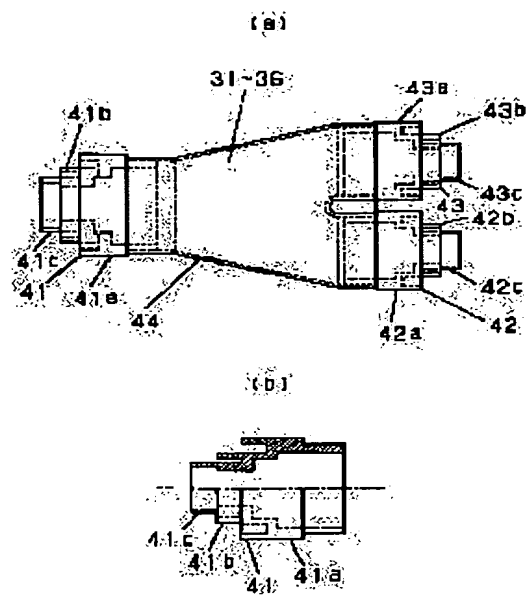
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## (54) AIR CONDITIONER

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve the degree of freedom of a design when refrigerant pipes are arranged, by a method wherein a refrigerant branching pipe to which the refrigerant pipes are connected is made smaller in the case where the refrigerant pipes are different in their diameters, in a multi-type air conditioner in which many indoor units are connected to an outdoor unit.

**SOLUTION:** Diametrically different multistage parts 41a, 41b, 41c, 42a, 42b, 42c, 43a, 43b, 43c to which refrigerant pipes having different diameters according to respective capacities of an outdoor unit and indoor units can be connected are formed at diametrically different pipe joint portions 41, 42, 43 of a refrigerant branching pipe main body 44 which connects refrigerant subpipes extending from the indoor units to a refrigerant main pipe extending from the outdoor unit.



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**CLAIMS**

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[Claim(s)]

[Claim 1] An outdoor unit and more numbers than the number of said outdoor units of indoor units are provided. Main coolant piping of the pair which is the air conditioner of multi-form which was parallel for refrigerant piping and connected the refrigerant possible [ circulation ] to said outdoor unit, and arranged [ to / from said outdoor unit / near the indoor unit ] each indoor unit, The air conditioner characterized by forming the different diameter multistage section which can connect refrigerant piping of a different path corresponding to the capacity of an outdoor unit and an indoor unit to the different diameter piping connection which connects subrefrigerant piping of an indoor unit.

[Claim 2] The air conditioner according to claim 1 characterized by forming the different diameter multistage section in the both ends of a different diameter piping connection.

[Claim 3] The air conditioner according to claim 1 or 2 characterized by forming the smooth taper section over the different diameter multistage section in the inside of a different diameter piping connection.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the air conditioner which was equipped with many numbers of indoor units rather than the number of outdoor units to the outdoor unit and which is called the so-called multi-form.

[0002]

[Description of the Prior Art] As a conventional air conditioner, it is shown, for example in JP,7-280376,A.

[0003] Hereafter, said conventional air conditioner is explained, referring to a drawing. Drawing 5

and drawing 6 are refrigerant branch pipes which have the different diameter piping connection of the conventional air conditioner.

[0004] In drawing 5, it is the subrefrigerant piping end connection to which 51 is prolonged to a main coolant piping end connection, and 52-55 prolong to each indoor unit. Moreover, in drawing 6, they are a main coolant piping end connection and the subrefrigerant piping end connection to which 61 is prolonged to 62 and 63 prolong to each indoor unit.

[0005] The conventional air conditioner constituted as mentioned above is explained. Main coolant piping (not shown) prolonged from the outdoor unit is connected to the subrefrigerant piping end connections 52-55 near the indoor unit through the main coolant piping end connection 51. Since a line size changes according to the capacity of an outdoor unit at this time, when the path of main coolant piping suits path voluminousness 51a in the main coolant piping end connection 51, it can connect as it is, but when it does not suit path voluminousness 51a, all of path voluminousness 51a are cut and small diameter part 51b is connected according to the path of main coolant piping. Moreover, although it connects using the subrefrigerant piping end connections 52-55, when small diameter parts 52a, 53a, 54a, and 55a do not suit subrefrigerant piping (not shown) of an indoor unit to each indoor unit according to the capacity of an indoor unit in this case, the small diameter part which a path does not suit will be cut to it, and it will connect with it using path voluminousness 52b, and 53b, 54b or 55b.

[0006] Moreover, the same is said of the case of the branch pipe shown in drawing 6, and when the line size of main coolant piping suits small diameter part 61a in the main coolant piping end connection 61, it can connect as it is, but when it does not suit small diameter part 61a, all of small diameter part 61a are cut, and it connects by path voluminousness 61b according to the path of main coolant piping. Moreover, although it connects using the subrefrigerant piping end connections 62 and 63, according to the capacity of an indoor unit, all the small diameter parts 62a and 63a will be cut to each indoor unit also in this case, and it will connect with it by path voluminousness 62b and 63b.

[0007]

[Problem(s) to be Solved by the Invention] In such a refrigerant branch pipe however, for different diameter piping connection The cutting part which has the need dimension T1 for cutting, the expansion processing part which has the dimension T2 for processing required for expansion processing, Since the tool insertion part which has lower limit T3 for the tool for cutting to enter, and the bending part which has dimension T four for processing required for bending are required, It is also the cause of these parts being the cause which enlarges the dimension of the whole refrigerant branch pipe, and reducing the design degree of freedom at the time of refrigerant piping installation, as a result reducing the workability at the time of piping installation.

[0008] This invention solves said conventional technical problem, can make small the configuration of the refrigerant branch pipe of an air conditioner, raises the design degree of freedom at the time of refrigerant piping installation, and sets the increase in efficiency of installation as the 1st purpose.

[0009] Moreover, in addition to said 1st purpose, it sets it as the 2nd purpose to diversify the combination at the time of different diameter piping connection.

[0010] Moreover, it sets it as the 3rd purpose to reduce the said 1st and 2nd turbulent flow generating in the different diameter piping connection circles in eye in addition.

[0011]

[Means for Solving the Problem] In order to attain said 1st purpose, the air conditioner of this invention prepares the different diameter multistage section in a different diameter piping connection, and is taken as the configuration which shortens the overall length of a refrigerant branch pipe.

[0012] Moreover, in order to attain said 2nd purpose, the different diameter multistage section is prepared in the both sides of a different diameter piping connection, and it considers as the configuration which can connect different diameter piping by the different diameter piping connection independent.

[0013] Moreover, in order to attain said 3rd purpose, the taper section over the different

diameter multistage section is formed in the interior of a different diameter piping connection, and passage is graduated, and in case a refrigerant flows, it considers as the configuration which cannot be easily influenced by the configuration.

[0014]

[Embodiment of the Invention] Although this invention can make the gestalt of operation the configuration indicated to each claim, in order to make the operation easy, a configuration and an operation are described below.

[0015] Invention of this invention according to claim 1 by making into the variant multistage section the different diameter piping connection for connecting an indoor unit to main coolant piping arranged from the outdoor unit of an air conditioner from needs, such as expansion at the time of pipe processing, and pipe shrinking processing It is characterized by making the volume of a refrigerant branch pipe small, the design degree of freedom at the time of refrigerant piping installation is raised, a piping cutting activity is abolished, and it has an operation of increasing the efficiency of installation of refrigerant piping.

[0016] Moreover, invention according to claim 2 has an operation that it can respond to the versatility at the time of piping connection by the different diameter piping connection independent by forming the different diameter multistage section in the both ends of a different diameter piping connection.

[0017] Moreover, invention according to claim 3 forms and graduates the taper section ranging over the different diameter multistage section inside a different diameter piping connection, in case a refrigerant flows, it is characterized by considering as the configuration which cannot be easily influenced by the configuration, and it has the operation of the reduction of resistance which the refrigerant in a different diameter piping connection receives.

[0018] Hereafter, the gestalt of operation of this invention is explained using drawing 4 from drawing 1.

(Gestalt 1 of operation) Drawing 1 shows the refrigerant piping schematic diagram of the air conditioner in the gestalt 1 of operation of this invention, and connects two or more sets of the indoor units B, C, and D arranged indoors respectively at one set [ of an outdoor unit ] A. The main coolant piping 21 and 22 arranged from outdoor unit A is connected to the subrefrigerant piping 23-28 by the side of indoor units B and C and D through the refrigerant branch pipes 31-36 in order near the indoor units B, C, and D.

[0019] Drawing 2 (a) is the side elevation of the refrigerant branch pipes 31-36 used above. 41 is the different diameter piping connection connected to the main coolant piping 21 or 22, and shows the cutting-into-half side cross section of the different diameter piping connection 41 which formed the different diameter multistage sections 41a, 41b, and 41c in drawing 2 (b). Therefore, since it does not have a configuration at the time of connecting different diameter piping like before but has the different diameter multistage sections 41a, 41b, and 41c, the diameter of connection is chosen according to a line size, and it can connect. 42 and 43 are different diameter piping connections connected to main coolant piping after an indoor unit or branching, and have the same composition as the different diameter piping connection 41. 44 is a body of a refrigerant branch pipe. Therefore, there are the different diameter multistage sections 41a-41c, 42a-42c, and 43a-43c in each different diameter piping connections 41, 42, and 43, and it can connect corresponding to the main coolant piping 21 or 22 and the subrefrigerant piping 23-28 from which a path differs.

[0020] As explained above, since it does not have a configuration for not needing cutting of a piping connection like before, and cutting according to the size of the capacity of outdoor and indoor each unit, the complete product and overall length of a refrigerant branch pipe can be made small, a design degree of freedom will increase, and improvement in working efficiency can be aimed at.

[0021] In addition, also in the case of many branching [ as shown in drawing 5 ], it is applied although the gestalt 1 of this operation shows the case of dichotomy.

[0022] (Gestalt 2 of operation) Drawing 3 shows the different diameter piping connection 45 of the refrigerant branch pipe of the air conditioner in the gestalt 2 of operation of this invention, and the different diameter multistage sections 45a, 45b, and 45c are constituted by the both

sides of the different diameter piping connection 45.

[0023] Not to mention connecting according to the path of refrigerant piping by the above configuration, it can connect without not cutting according to the aperture of refrigerant piping like before, and using new components, communalization of components can be attained, and a design degree of freedom will increase further.

[0024] (Gestalt 3 of operation) Drawing 4 shows the different diameter piping connection 46 of the refrigerant branch pipe of the air conditioner in the gestalt 3 of operation of this invention, processes the interior of the different diameter multistage sections 46a, 46b, and 46c in the shape of a cone, and forms the taper section 47 ranging over the different diameter multistage section. Thereby, within the different diameter piping connection 46, it is canceled that a level difference is made by the difference in a line size.

[0025] Effect by the configuration can be made hard to be influenced, in case flow of the refrigerant produced in the different diameter piping connection 46 in case a refrigerant branch pipe is connected is smoothed and a refrigerant flows by the taper section 47 explained above.

[0026]

[Effect of the Invention] Since it considered as the configuration which the different diameter multistage section is prepared [ configuration ] in a different diameter piping connection, and shortens the overall length of the body of a refrigerant branch pipe according to invention according to claim 1 in order to attain the 1st purpose as explained above, the configuration of refrigerant piping of an air conditioner can be made small, the design degree of freedom at the time of refrigerant piping installation is raised, and the increase in efficiency of installation can be attained.

[0027] Moreover, since according to invention according to claim 2 it considered as the configuration which prepares the different diameter multistage section in the both sides of a different diameter piping connection, and can connect different diameter piping by the different diameter piping connection independent in order to attain the 2nd purpose, the combination at the time of different diameter piping connection can be diversified, and it becomes that piping connection is possible, without following cutting processing at the time of a piping activity.

[0028] Moreover, it can be made hard to receive the effect by the configuration, in case a refrigerant flows since according to invention according to claim 3 it has the operation of the reduction of resistance which is characterized by considering as the configuration which cannot be easily influenced by the configuration, and the refrigerant in a different diameter piping connection receives in case the interior of a different diameter piping connection is graduated and a refrigerant flows, in order to attain the 3rd purpose.

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**DESCRIPTION OF DRAWINGS**

[Brief Description of the Drawings]

[Drawing 1] The refrigerant piping schematic diagram of the air conditioner in the gestalt 1 of operation of this invention

[Drawing 2] (a) The side elevation of the body of a refrigerant branch pipe of the air conditioner in the gestalt 1 of this operation

(b) The cutting-into-half sectional side elevation of the different diameter piping connection of the body of a refrigerant branch pipe of the air conditioner in the gestalt 1 of this operation

[Drawing 3] The cutting-into-half sectional side elevation of the different diameter piping connection of the refrigerant branch pipe of the air conditioner in the gestalt 2 of operation of this invention

[Drawing 4] The cutting-into-half sectional side elevation of the different diameter piping connection of the refrigerant branch pipe of the air conditioner in the gestalt 3 of operation of this invention

[Drawing 5] The important section side elevation of the refrigerant branch pipe which has the different diameter piping connection of the conventional air conditioner

[Drawing 6] The important section side elevation of the refrigerant branch pipe which has the different diameter piping connection of other conventional air conditioners

[Description of Notations]

21 22 Main coolant piping

23, 24, 25, 26, 27, 28 Subrefrigerant piping

31, 32, 33, 34, 35, 36 Refrigerant branch pipe

41, 42, 43, 45, 46 Different diameter piping connection

41a, 41b, 41c, 42a, 42b, 42c, 45a, 45b, 45c, 46a, 46b, 46c Different diameter multistage section

44 Body of Refrigerant Branch Pipe

47 Taper Section

A Outdoor unit

B, C, D Indoor unit

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[Translation done.]

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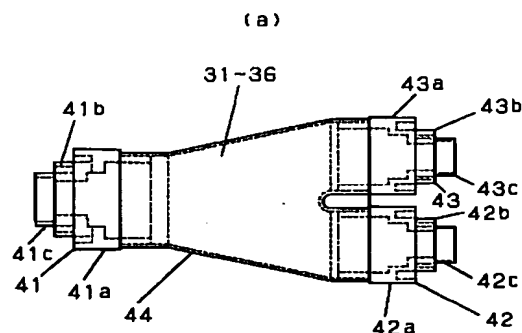
(54)【発明の名称】 空気調和機

(57)【要約】

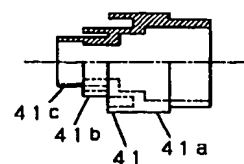
【課題】 室外ユニットに対し、多くの室内ユニットを接続するマルチ型式の空気調和機において、冷媒配管の径が異なる場合に、冷媒配管を接続する冷媒分岐管を小さくし、冷媒配管設置時の設計自由度を向上させる。

【解決手段】 室外ユニットからの主冷媒配管に室内ユニットからの副冷媒配管を接続する冷媒分岐管本体44の異径配管接続部41、42、43に、室外ユニットおよび室内ユニットの能力に対応した異なる径の冷媒配管が接続可能な異径多段部41a、41b、41c、42a、42b、42c、43a、43b、43cを形成する。

41、42、43 異径配管接続部  
41a、41b、41c  
42a、42b、42c  
43a、43b、43c 異径多段部  
44 冷媒分岐管本体



(b)



【特許請求の範囲】

【請求項1】 室外ユニットと、前記室外ユニットの数よりも多い数の室内ユニットを具備し、各室内ユニットを冷媒配管で並列でかつ前記室外ユニットに対して冷媒が循環可能に接続したマルチ型式の空気調和機であって、前記室外ユニットから室内ユニットの近傍まで配設した一对の主冷媒配管と、室内ユニットの副冷媒配管を接続する異径配管接続部に、室外ユニットおよび室内ユニットの能力に対応した異なる径の冷媒配管が接続可能な異径多段部を形成したことを特徴とする空気調和機。

【請求項2】 異径配管接続部の両端に異径多段部を形成したことを特徴とする請求項1記載の空気調和機。

【請求項3】 異径配管接続部の内面に異径多段部にまたがった滑らかなテーパ一部を形成したことを特徴とする請求項1または2記載の空気調和機。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、室外ユニットに対して室外ユニットの数よりも多い数の室内ユニットを備えた、所謂マルチ型式と呼ばれる空気調和機に関するものである。

【0002】

【従来の技術】従来の空気調和機としては、例えば特開平7-280376号公報に示されている。

【0003】以下、前記従来の空気調和機について、図面を参照しながら説明する。図5および図6は、従来の空気調和機の異径配管接続部を有する冷媒分岐管である。

【0004】図5において、51は主冷媒配管接続口、52～55は各々の室内ユニットへ延びる副冷媒配管接続口である。また、図6において、61は主冷媒配管接続口、62、63は各々の室内ユニットへ延びる副冷媒配管接続口である。

【0005】以上のように構成された従来の空気調和機について説明する。室外ユニットから延びてきた主冷媒配管（図示せず）は、主冷媒配管接続口51を介して室内ユニットの近傍で副冷媒配管接続口52～55に接続される。このとき室外ユニットの容量に応じて配管径が変わるため、主冷媒配管の径が主冷媒配管接続口51において、径大部51aに合う場合は、そのまま接続可能であるが、径大部51aに合わない場合は、径大部51aの全てを切断して、径小部51bを主冷媒配管の径に合わせて接続をおこなう。また、各々の室内ユニットへは、副冷媒配管接続口52～55を利用して接続するのであるが、この場合も室内ユニットの容量に応じて、径小部52a、53a、54a、55aが室内ユニットの副冷媒配管（図示せず）に合わないときは径が合わない径小部を切断して、径大部52b、53b、54bまたは55bを利用して接続することになる。

【0006】また、図6に示す分岐管の場合も同様で、

主冷媒配管接続口61において主冷媒配管の配管径が径小部61aに合う場合は、そのまま接続可能であるが、径小部61aに合わない場合は、径小部61aの全てを切断して、主冷媒配管の径に合わせて径大部61bによって接続をおこなう。また、各々の室内ユニットへは、副冷媒配管接続口62、63を利用して接続するのであるが、この場合も室内ユニットの容量に応じて、径小部62a、63aの全てを切断して、径大部62b、63bにより接続することになる。

【0007】

【発明が解決しようとする課題】しかしながら、このような冷媒分岐管において、異径配管接続のために、切断用の必要寸法T1を有する切断部分、拡張加工に必要な加工用寸法T2を有する拡張加工部分、切断用の工具が入るための最小寸法T3を有する工具挿入部分、そして曲げ加工に必要な加工用寸法T4を有する曲げ加工部分が必要なため、これらの部分が冷媒分岐管全体の寸法を大きくしている原因になっており、冷媒配管施工時の設計自由度を低下させ、ひいては配管施工時の作業性を低下させる原因ともなっている。

【0008】本発明は、前記従来の課題を解決するもので、空気調和機の冷媒分岐管の形状を小さくすることができ冷媒配管設置時の設計自由度を向上させ、設置作業の効率化を第1の目的とする。

【0009】また、前記第1の目的に加えて、異径配管接続時の組合せを多様化することを第2の目的とする。

【0010】また、前記第1、第2の目的に加えて、異径配管接続部内での乱流発生を低減することを第3の目的とする。

【0011】

【課題を解決するための手段】前記第1の目的を達成するために本発明の空気調和機は、異径配管接続部に異径多段部を設け、冷媒分岐管の全長を短縮させる構成とする。

【0012】また、前記第2の目的を達成するために、異径多段部を異径配管接続部の両側に設け、異径配管接続部単独で異径配管を接続できる構成とする。

【0013】また、前記第3の目的を達成するために、異径配管接続部の内部に異径多段部にまたがったテーパ一部を形成して流路を平滑化し、冷媒が流れる際に形状による影響を受けにくい構成とする。

【0014】

【発明の実施の形態】本発明は各請求項に記載した構成を実施の形態とすることができるのであるが、その実施を容易にするために構成と作用を以下に述べる。

【0015】本発明の請求項1に記載の発明は、空気調和機の室外ユニットから配設されてきた主冷媒配管に室内ユニットを接続するための異径配管接続部をパイプ加工時の拡張、縮加工などの必要性から異形多段部とすることにより、冷媒分岐管の容積を小さくすることを特



徴としたものであり、冷媒配管設置時の設計自由度を向上させ、配管切断作業をなくして、冷媒配管の設置作業を効率化するという作用を有する。

【0016】また、請求項2に記載の発明は、異径配管接続部の両端に異径多段部を形成することで異径配管接続部単独で配管接続時の多様性に対応できるという作用を有する。

【0017】また、請求項3に記載の発明は、異径配管接続部の内部に異径多段部にまたがってテーパ部を形成して平滑化し、冷媒が流れる際に形状による影響を受けにくい構成とすることを特徴としたものであり、異径配管接続部での冷媒が受ける抵抗の低減という作用を有する。

【0018】以下、本発明の実施の形態について図1から図4を用いて説明する。

(実施の形態1) 図1は本発明の実施の形態1における空気調和機の冷媒配管系統図を示し、1台の室外ユニットAに、各々室内に配置される複数台の室内ユニットB、C、Dを接続する。室外ユニットAから配設された主冷媒配管21、22は室内ユニットB、C、Dの近傍で順番に室内ユニットB、C、D側の副冷媒配管23～28へ冷媒分岐管31～36を介して接続される。

【0019】図2(a)は前記で用いる冷媒分岐管31～36の側面図である。41は主冷媒配管21または22に接続される異径配管接続部で、図2(b)に異径多段部41a、41b、41cを形成した異径配管接続部41の半截側断面を示す。従って従来のように異径配管を接続する際の構成を持たず、異径多段部41a、41b、41cを有しているため配管径に応じて接続径を選択して接続できるようになっている。42、43は室内ユニットあるいは分岐後の主冷媒配管に接続される異径配管接続部であり、異径配管接続部41と同様の構成となっている。44は冷媒分岐管本体である。従って、各異径配管接続部41、42、43には異径多段部41a～41c、42a～42c、43a～43cがあって、径が異なる主冷媒配管21または22、副冷媒配管23～28に対応して接続することができる。

【0020】以上に説明したように、室外、室内各ユニットの能力の大小に応じて、従来のように配管接続部の切断作業を必要とせず、また切断するための構成を持たないため、冷媒分岐管の全容積および全長を小さくすることができ、設計自由度が増すことになり、作業効率の向上が図れる。

【0021】なお、本実施の形態1では2分岐の場合を示しているが、図5に示すような、多分岐の場合でも適用される。

【0022】(実施の形態2) 図3は本発明の実施の形態2における空気調和機の冷媒分岐管の異径配管接続部45を示し、異径多段部45a、45b、45cが、異径配管接続部45の両側に構成されている。

【0023】以上の構成により冷媒配管の径に応じて接続されるのはもちろんのこと、従来のように冷媒配管の口径に応じて切断することがなく、また新たな部品を使用することなく接続でき、部品の共通化が図れ、さらに設計自由度が増すことになる。

【0024】(実施の形態3) 図4は本発明の実施の形態3における空気調和機の冷媒分岐管の異径配管接続部46を示し、異径多段部46a、46b、46cの内部を円錐状に加工し異径多段部にまたがってテーパ部47を形成したものである。これにより、異径配管接続部46内では配管径の違いにより段差ができることが解消される。

【0025】以上説明したテーパ部47により、冷媒分岐管を接続する際、異径配管接続部46で生じる冷媒の流れを滑らかにし、冷媒が流れる際に形状による影響を受けにくくすることができる。

【0026】

【発明の効果】以上説明したように、請求項1記載の発明によれば、第1の目的を達成するために異径配管接続部に異径多段部を設け、冷媒分岐管本体の全長を短縮させる構成としたので、空気調和機の冷媒配管の形状を小さくすることができて冷媒配管設置時の設計自由度を向上させ、設置作業の効率化を図れる。

【0027】また、請求項2記載の発明によれば、第2の目的を達成するために異径配管接続部の両側に異径多段部を設け、異径配管接続部単独で異径配管を接続できる構成としたので、異径配管接続時の組合せを多様化することができ、配管作業時の切断加工を伴わずに配管接続が可能となる。

【0028】また、請求項3記載の発明によれば、第3の目的を達成するために異径配管接続部の内部を平滑化し、冷媒が流れる際に形状による影響を受けにくい構成とすることを特徴としたものであり、異径配管接続部での冷媒が受ける抵抗の低減という作用を有するため、冷媒が流れる際に形状による影響を受けにくくすることができる。

【図面の簡単な説明】

【図1】本発明の実施の形態1における空気調和機の冷媒配管系統図

【図2】(a) 同実施の形態1における空気調和機の冷媒分岐管本体の側面図

(b) 同実施の形態1における空気調和機の冷媒分岐管本体の異径配管接続部の半截側断面図

【図3】本発明の実施の形態2における空気調和機の冷媒分岐管の異径配管接続部の半截側断面図

【図4】本発明の実施の形態3における空気調和機の冷媒分岐管の異径配管接続部の半截側断面図

【図5】従来の空気調和機の異径配管接続部を有する冷媒分岐管の要部側面図

【図6】他の従来の空気調和機の異径配管接続部を有す

る冷媒分岐管の要部側面図

【符号の説明】

21, 22 主冷媒配管  
23, 24, 25, 26, 27, 28 副冷媒配管  
31, 32, 33, 34, 35, 36 冷媒分岐管  
41, 42, 43, 45, 46 異径配管接続部  
41a, 41b, 41c, 42a, 42b, 42c, 4

5a, 45b, 45c, 46a, 46b, 46c 異径  
多段部

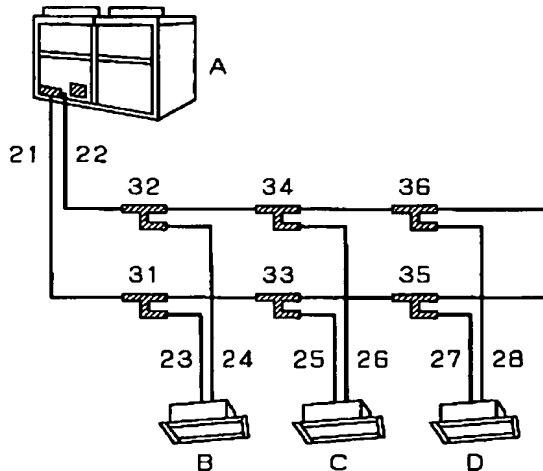
44 冷媒分岐管本体

47 テーパー部

A 室外ユニット

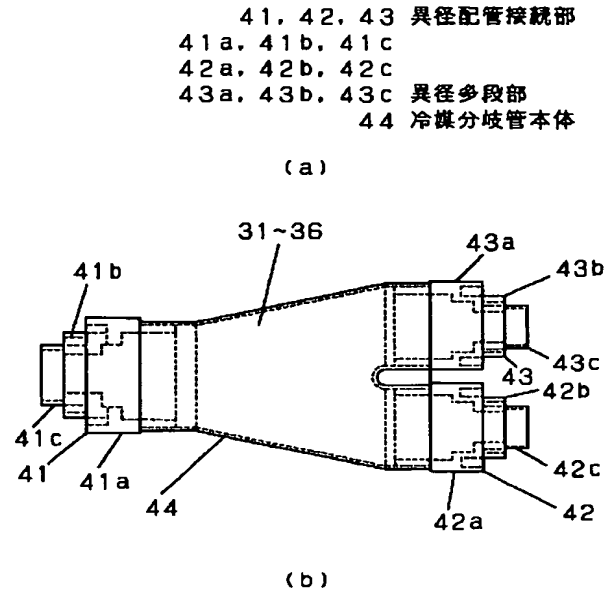
B, C, D 室内ユニット

【図1】



21, 22 主冷媒配管  
23~28 副冷媒配管  
31~36 冷媒分岐管  
A 室外ユニット  
B, C, D 室内ユニット

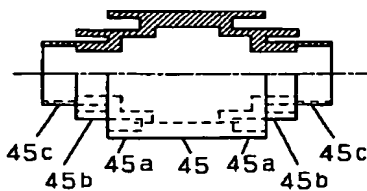
【図2】



41, 42, 43 異径配管接続部  
41a, 41b, 41c  
42a, 42b, 42c  
43a, 43b, 43c 異径多段部  
44 冷媒分岐管本体

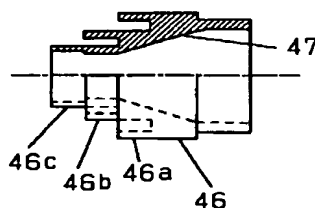
【図3】

45 異径配管接続部  
45a, 45b, 45c 異径多段部

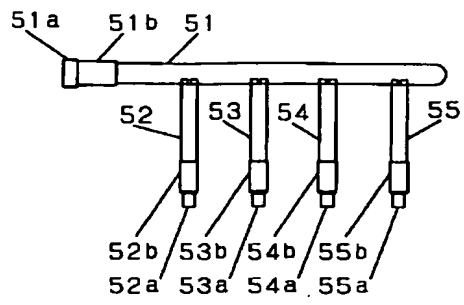


【図4】

46 異径配管接続部  
46a, 46b, 46c 異径多段部  
47 テーパー部



【図5】



【図6】

